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(71)Applicant : TOYOTA MOTOR CORP

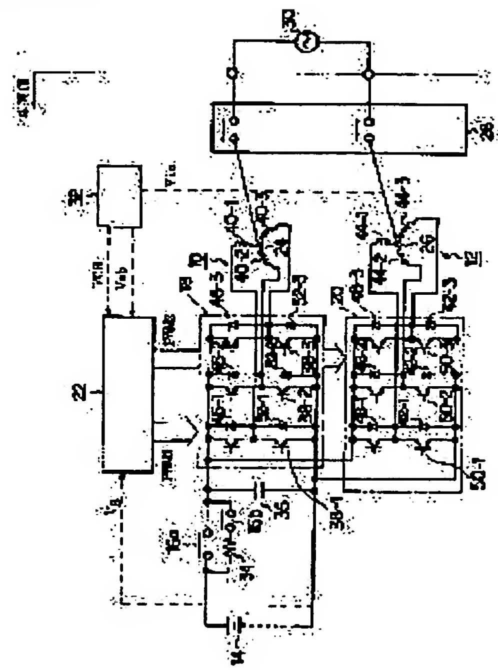
(72)Inventor : ISHIKAWA TETSUHIRO
KATSUTA TOSHIHIRO
KUNO HIROMICHI
SEKIMORI TOSHIYUKI

(54) CHARGING APPARATUS MOUNTED ON ELECTRIC AUTOMOBILE

(57)Abstract:

PURPOSE: To prevent the rotation of a rotor and the movement of a vehicle when the coils of drive motors are used as reactors and a battery is charged in an electric automobile.

CONSTITUTION: The two terminals of a commercial power supply 30 are connected to neutral points 24 and 26 of the two drive motors 10 and 12, respectively. Transistors 38-1,-2 and-3 and 50-1,-2 and-3 of inverters 18 and 20 are controlled so that the equal current flows through three-phase coils 40-1,-2 and-3 and 44-1,-2 and-3. Therefore, the magnetic fields generated from the three-phase coils are offset to each other. Thus, the magnetic field is not formed, the rotation of a rotor can be prevented and the vehicle does not start moving.



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CLAIMS

[Claim(s)]
[Claim 1] Two permanent magnet motors for a car drive, and two inverters which control the current which is established for said every two permanent magnet motors, and flows in the coil of the permanent magnet motor concerned, The connection circuit which connects a source power supply to said permanent magnet motor at each neutral point of the dc-battery which supplies power, and said two motors, Mounted charging equipment of the electric vehicle characterized by having the control circuit which controls the circuit element of said inverter, uses a current equal to the coil of the three phase circuit of said permanent magnet motor as a sink from a source power supply, and charges to said dc-battery by using these coils as the reactor for pressure ups.
[Claim 2] Two permanent magnet motors for a car drive, and two inverters which control the current which is established for said every two permanent magnet motors, and flows in the coil of the permanent magnet motor concerned, The connection circuit which connects a source power supply to said permanent magnet motor at each neutral point of the dc-battery which supplies power, and said two motors, The magnetic pole location sensor which detects the magnetic pole location of Rota of said permanent magnet motor, A coil selection means to select the coil of the plane 1 which generates the field from which the torque which rotates said Rota among the coils of the three phase circuit of said permanent magnet motor serves as min based on said detected magnetic pole location, or two phases, Mounted charging equipment of the electric vehicle characterized by having the control circuit which controls the circuit element of said inverter in the selected coil concerned, uses a current as a sink from a source power supply, and charges to said dc-battery by using these coils as the reactor for pressure ups.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is charging equipment which charges the dc-battery for a drive of an electric vehicle from a source power supply, and relates to the charging equipment of the electric vehicle which charges using the circuit element of the inverter which controls said motor, using especially the coil of a drive motor as a reactor.
[0002]
[Description of the Prior Art] In recent years, in consideration of the environmental problem, development of the electric vehicle which does not take out exhaust gas is furthered. An electric vehicle drives and runs a motor with the power stored in the mounted dc-battery. Therefore, charging equipment is needed in order to charge at a dc-battery. Charging equipment needs to move an electric vehicle to the location, when mounting, or when it can consider the case where fixed installation is carried out, at a certain point and is the latter, and it needs to charge. That is, when fixed installation is carried out, there is a fault that it cannot charge, except the location where fixed installation of the charging equipment was carried out. On the other hand, when charging equipment was mounted, there was a problem that car weight increased. In order to solve this problem, the equipment which performs charge from a source power supply for home use is conventionally proposed by using the coil of a drive motor as a reactor and controlling the circuit element of the inverter which controls said motor. By using the components which already exist in the case of this equipment, the newly carried components were reduced and the increment in weight is controlled.
[0003]
[Problem(s) to be Solved by the Invention] However, if a current is passed in the coil of the arbitration of a drive motor when the permanent magnet motor which has arranged the permanent magnet is used for Rota of a drive motor, the torque which is going to rotate Rota depending on the location (location of a magnetic pole) of the permanent magnet of Rota may occur. When Rota rotated by this torque, there was a problem that a car may move, at the time of charge.
[0004] It is made in order that this invention may solve the above-mentioned trouble, and it aims at offering the mounted charging equipment of the electric vehicle which Rota does not rotate at the time of charge.
[0005]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the mounted charging equipment of the electric vehicle concerning this invention Two permanent magnet motors for a car drive, and two inverters which control the current which is established for said every two permanent magnet motors, and flows in the coil of the permanent magnet motor concerned, The connection circuit which connects a source power supply to said permanent magnet motor at each neutral point of the dc-battery which supplies power, and said two motors, The circuit element of said inverter is controlled and it has the control circuit which uses a current equal to the coil of the three phase circuit of said permanent magnet motor as a sink from a source power supply, and charges to said dc-battery by using these coils as the reactor for pressure ups.
[0006] Moreover, the mounted charging equipment of other electric vehicles concerning this invention Two permanent magnet motors for a car drive, and two inverters which control the current which is established for said every two permanent magnet motors, and flows in the coil of the permanent magnet motor concerned, The connection circuit which connects a source power supply to said permanent magnet motor at each neutral point of the dc-battery which supplies power, and said two motors, The magnetic pole location sensor which detects the magnetic pole location of Rota of said permanent magnet motor, A coil selection means to select the coil of the plane 1 which generates the field from which the torque which rotates said

Rota among the coils of the three phase circuit of said permanent magnet motor serves as min based on said detected magnetic pole location, or two phases, The circuit element of said inverter is controlled in the selected coil concerned, and it has the control circuit which uses a current as a sink from a source power supply, and charges to said dc-battery by using these coils as the reactor for pressure ups.

[0007]

[Function] When this invention has the above configurations and it passes a current equal to the coil of the three phase circuit of a drive motor, the field to generate is offset mutually, serves as zero, and can prevent rotation of Rota. Furthermore, when selecting the coil of the plane 1 from which the torque which rotates Rota serves as min, or two phases based on the magnetic pole location of detected Rota and passing a current in the coil concerned, since torque is small, rotation of Rota can be prevented with the frictional resistance of a car etc.

[0008]

[Example] Hereafter, the suitable example of this invention is explained according to a drawing. The charge circuit using the main configuration of a drive circuit and this drive circuit of an electric vehicle is shown in drawing 1 . The electric vehicle of an example is equipped with two drive motors 10 and 12 as shown in drawing. These two drive motors 10 and 12 drive respectively the front wheel of right and left of an electric vehicle, or a rear wheel on either side, and make it run a car. Power is supplied to closed main-switch 16a and a pan through inverters 18 and 20 from a dc-battery 14 at drive motors 10 and 12. Inverters 18 and 20 are controlled by the control section 22 according to directions of the advance retreat by an operator's accelerator pedal, the control input of a steering, and actuation of a shift lever etc. For example, when it gets into an accelerator, power is further supplied from a dc-battery 14, and each transistor of inverters 18 and 20 is controlled to make driving torque and an engine speed increase. Moreover, when the accelerator pedal was returned, or when it gets into a brake pedal, each transistor is controlled to make drive motors 10 and 12 act as a generator, and the power generated by the dc-battery 14 is revived.

[0009] Thus, although the dc-battery of an electric vehicle repeats discharge and charge during transit, all kinetic energy of a car cannot be revived and the amount of accumulation of electricity of a dc-battery decreases gradually by various loss and use of a mounted electric equipment article. Therefore, when the car is not used, it is necessary to supply power from the exterior, and it is necessary to charge a dc-battery 14. Since it does not end in several minutes like oil supply, such as a gasoline of the usual automobile carrying an engine, or gas oil, as for charge of a dc-battery, it is desirable that it can carry out whenever it is opportune. That is, it goes to a predetermined location like a gas station, and it is not charged, for example, it is a house, a destination, etc., and it is desirable that it can charge while not using the car. for this reason -- being alike -- although it is desirable to mount the equipment for charge, now, there is a fault that the weight of a car increases, as mentioned above.

[0010] In the case of this example, the charge circuit is constituted using the field coil and inverters 18 and 20 of drive motors 10 and 12. That is, a source power supply 30 (single-phase alternative current 100V) is connectable through the short circuit breaker 28 with the plug for charge at each neutral points 24 and 26 of drive motors 10 and 12. Furthermore, the polar judgment section 32 which judges the polarity of the electrical potential difference Vin supplied from a source power supply 30 is formed. In the polar judgment section 32, the polar signal VCH which shows the polarity of input voltage Vin is outputted. Moreover, the absolute value signal Vab showing the absolute value of input voltage Vin is outputted. Based on these polar signals VCH and absolute value signals Vab, a control section 22 carries out PWM control of the inverters 18 and 20, and charge is performed.

[0011] It explains in more detail about charge actuation. In case it charges, an operator inserts the plug for charge of a car in the plug socket of a source power supply. At this time, the short circuit breaker 28 is in the open condition, and the neutral points 24 and 26 of a source power supply and a drive motor are in the condition of not connecting yet. If charge actuation is directed, it will be arranged at juxtaposition at main-switch 16a, subswitch 16b connected to the limit resistance 34 at the serial will be closed, and a capacitor 36 will be charged. If the both-ends electrical potential difference of this capacitor 36 becomes almost equal to the terminal voltage of a dc-battery 14, the switch of the short circuit breaker 28 and main-switch 16a will be closed. Input voltage Vin occurs between two drive motors 10 and 12, and a control section 22 performs PWM control of inverters 18 and 20 based on the phase of this electrical potential difference as mentioned above.

[0012] It is shown to drawing 2 by comparison by the PWM signal which performs input voltage Vin, the polar signal VCH, and PWM control. When the neutral point 24 is impressed to the polarity of input voltage Vin as a positive electrode, as for the polar signal VCH of the phase judging section 32, in n pi/f (n+1) to

pi/f (n is even number), the phase of input voltage will be in Hi condition. When the polar signal VCH is Hi, a control section 22 generates PWM1 signal which controls an inverter 18. When this PWM1 signal is Hi, the control transistor 38-1 of an inverter 18, 38-2, and 38-3 will be in switch-on, and will be in non-switch-on at the time of Lo. (About these transistors, unless it is necessary to distinguish henceforth, it is only described as a transistor 38.) If a transistor 38 will be in switch-on A current flows from the neutral point 24 to each of the coil 40-1 of the three phase circuit of a drive motor 10, 40-2, and 40-3. It flows through a transistor 38 at the neutral point 26 through the diode 42-1 of an inverter 20, 42-2, 42-3 and each coil 44-1 of the three phase circuit of a drive motor 12, 44-2, and 44-3 further. (Like a transistor 38, unless three components need to be distinguished respectively, it is only described as a coil 40, diode 42, and a coil 44.) At this time, energy is stored in each coils 40 and 44 of drive motors 10 and 12. If a transistor 38 is made into the condition of not flowing, in this condition, the energy stored in coils 40 and 44 will flow to a dc-battery 14 through each diode 46-1 of inverters 18 and 20, 46-2, 46-3, and diode 48-1, 48-2 and 48-3, and charge will be performed. (Also about such diodes, it is described as diodes 46 and 48.) As shown in drawing 2 , the pulse width of an PWM signal changes with absolute values of input voltage Vin. Control is performed so that the absolute value Vab of the electrical potential difference which is set that the energy stored in coils 40 and 44 among one pulse becomes fixed [this pulse width], therefore is inputted into a control section 22 is large, and pulse width may become small. Moreover, the energy stored in a coil is set constant for seting the charging current constant, and charge stabilized by this is performed.

[0013] Next, when the neutral point 26 becomes a positive electrode, at the time of pi/f (n+1) (n+2) to pi/f (n is even number), the polar signal VCH serves as [the phase of input voltage] Lo. When the polar signal VCH is Lo, a control section 22 generates PWM2 signal which controls an inverter 20. When this PWM2 signal is Hi, the transistor 50-1 of an inverter 20, 50-2, and 50-3 will be in switch-on. (It is henceforth described as a transistor 50.) Therefore, a current flows through the coil 44 of a three phase circuit, and a transistor 50 at the neutral point 24 through the diode 52-1 of an inverter 18, 52-2, 52-3 (it is henceforth described as diode 52), and a coil 40 further from the neutral point 26. If energy is stored in each coils 40 and 44 at this time and a transistor 50 is controlled by un-flowing, this stored energy will serve as a current, it will flow to a dc-battery 14 through diodes 46 and 48, and charge will be performed. It is controlled so that the pulse width of PWM2 signal also becomes small when the absolute value Vab of input voltage is large, and it becomes fixed [the charging current] at this time. [as well as PWM1 signal]

[0014] And signal VB showing the terminal voltage of a dc-battery 14 It is based, and if a control section 22 judges that the dc-battery changed into the full charge condition, charge control of inverters 18 and 20 will be ended.

[0015] In the case of this example, the field which a coil generates is offset by passing an equal current respectively to the coil 40-1 of the three phase circuit of a drive motor 10, 40-2, 40-3 and the coil 44-1 of the three phase circuit of a drive motor 12, 44-2, and 44-3. Therefore, it can prevent that Rota does not rotate and a car moves at the time of charge.

[0016] Other examples concerning this invention are shown in drawing 3 . In this example, the sign same about the same component as the example shown in drawing 1 is attached, and the explanation is omitted. It is that it is characteristic in this example in the point that the magnetic pole location sensors 54 and 56 which detect the magnetic pole location of Rota of drive motors 10 and 12 are formed, and control based on the detected magnetic pole location is performed by the control section 58.

[0017] Each position signal m1 detected by the magnetic pole location sensors 54 and 56, and m2 It is sent to a control section 58. The torque which rotates Rota when a control section 58 passes a current about a drive motor 10 in one coil of the coil 40-1 of a three phase circuit, 40-2, and 40-3 when the polarity of a source power supply 30 is [the neutral point 24] a positive electrode, and a field occurs chooses the coil used as min. The coil nearest to the magnetic pole location of Rota is chosen, and specifically, one of the transistor 38-1 of an inverter 18, 38-2, and 38-3 is controlled by PWM1 signal so that a current flows in this coil. On the other hand, a current equal to the coil of the three phase circuit of the drive motor 12 by the side of a negative electrode flows. And if the transistor which was switch-on will be in non-switch-on, the energy stored in the coil like the above-mentioned example will be charged by the dc-battery 14.

[0018] When the polarity of a source power supply 30 is a positive electrode, the neutral point 26 When a current is passed in one coil of the coil 44-1 of a three phase circuit, 44-2, and 44-3 and a field occurs about a drive motor 12, a control section 58 The coil with which the torque which rotates Rota serves as min is chosen, and one of the transistor 50-1 of an inverter 20, 50-2, and the 50-3 is chosen so that a current may flow in this coil. And this transistor is controlled by PWM2 signal and charge is performed.

[0019] As mentioned above, in the example shown in drawing 3 , generating of the torque which rotates

Rota can be controlled in the drive motor by the side of the positive electrode of a source power supply by choosing the coil of the phase nearest to the magnetic pole location of Rota, and passing a current to this. Moreover, in the drive motor by the side of the negative electrode of a source power supply, since a current flows in the coils of all three phase circuits, the torque which the field which each coil generates makes rotate mutual phase murder and Rota is not generated. Moreover, in this example, since the transistor controlled is one per inverter, control can be simplified.
[0020] Moreover, in the example shown in drawing 3 , although control was performed so that a current might be passed to any one of the coils of a three phase circuit, when the magnetic pole of Rota is located in the middle of the coil of two phases, although it is small, the torque turning around Rota occurs. In such a case, it is also possible to charge by controlling two transistors so that a current may be passed in the coil of two phases in the location whose magnetic pole is pinched. Thus, torque which rotates Rota can be made still smaller by choosing the coil of a plane 1 or two phases based on a magnetic pole location.
[0021]
[Effect of the Invention] When passing a current equal to all the coils of the three phase circuit of a drive motor as mentioned above according to this invention, since the field which the coil of each phase generates offsets each other mutually, generating of the torque which rotates Rota can be prevented. Moreover, generating of torque can be controlled by passing a current based on the magnetic pole location of Rota in the coil of the plane 1 from which the torque which rotates Rota serves as min, or two phases. And the torque which rotates Rota controls 0 or that this torque becomes large from the rolling resistance of a tire, or the frictional resistance of the bearing section since it is small, and it can prevent that a car moves during charge.

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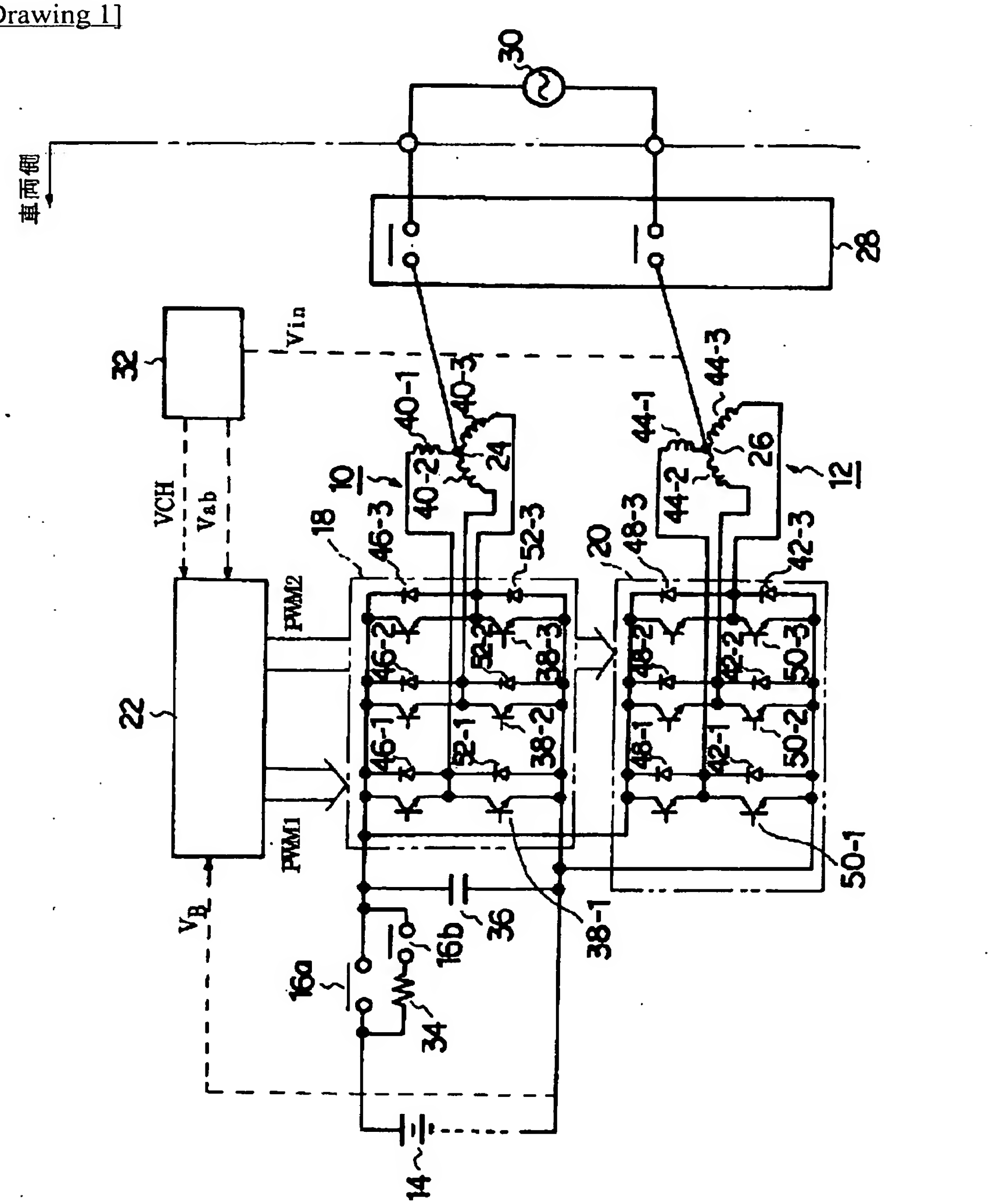
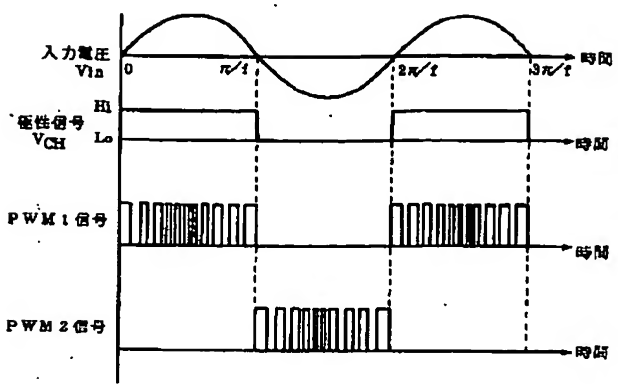
DRAWINGS

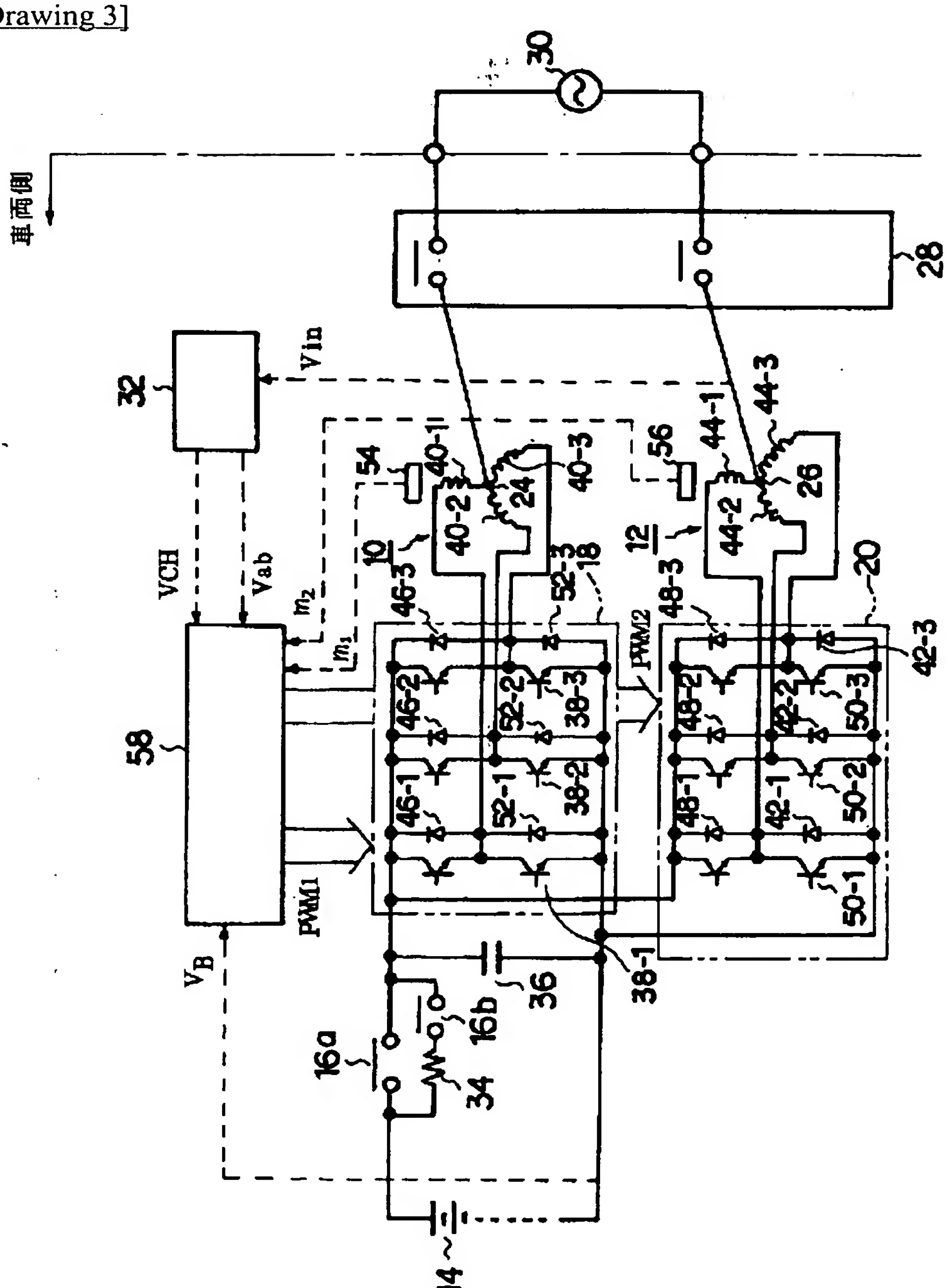
[Drawing 1]



[Drawing 2]



[Drawing 3]



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